

WASHINGTON

SCIENCE TRENDS

HIGHLIGHTS

- * COMMUNICATIONS SATELLITES
- * SCOUT VEHICLE PROGRAM
- * CENTAUR VEHICLE PROGRAM
- * TECHNICAL TRENDS
- * RESEARCH CHECKLIST
- * PUBLICATION CHECKLIST

Vol. V, No. 26

March 13, 1961

* COMMUNICATIONS SATELLITES

Here are the major research aspects of the accelerated "Active" communications satellite program now being advocated by the National Aeronautics and Space Administration:

- ✓ Research must be initiated immediately to determine the extent of radiation damage to satellite components in the space environment. Little knowledge is now available on the effect of radiation upon the performance of solar cells, transistors and other solid state components.
 - ✓ Concurrently, the development of radiation resistant materials must be undertaken. New materials such as gallium arsenide and cadmium sulfide are believed to offer promise of greater resistance to radiation damage.
 - ✓ NASA believes that recent developments in long-lived components, particularly in traveling wave tubes, indicate the technical and economic feasibility of an active repeater satellite system. Extra funds would be used to initiate the rapid development and demonstration of an operational system using low altitude active repeaters.
- Programs for the development of so-called "passive" satellites for communication are directed toward:
- ✓ Development of techniques for rigidizing the reflecting structure in space to increase orbital life.
 - ✓ Development of techniques for ejecting more than one satellite into a predictable orbit from a single launch vehicle.
 - ✓ Development of improved ground transmission and receiving equipment, including equipment operating at high, more nearly optimum microwave frequencies.

* MATERIALS RESEARCH INDEX

The Atomic Energy Commission is considering issuing a Materials Research Index, which would maintain an up-to-date listing of research underway on materials, such as ceramic-based fuel elements, niobium-uranium fuel alloys for high-temperature operation, and development of fuel-bearing fiber-glass fuel elements. AEC says that if this pilot project is undertaken, and proves practical, similar efforts will be made to disseminate information on research and development in other reactor fields.

Subscribers Please Note

Effectively immediately, Washington SCIENCE TRENDS moves to larger quarters at 998 National Press Building, Washington 4, D. C. Telephone EXecutive 3-0031. We wish to thank our many readers who have made this expansion necessary -- and possible.

* SCOUT VEHICLE PROGRAM

National Aeronautics and Space Administration expects to increase its spending on the Scout launching vehicle for orbital, probe and reentry missions. The so-called "poor man's rocket" being built by Chance Vought as prime contractor, is said to cost about \$935,000 per vehicle, including the cost of launching.

Additional funds now being requested for will be applied primarily to the development of improved motor capability, increased nose cone diameter, standardization of the basic vehicle design and completion of component qualification tests.

Scout vehicle, in its present configuration is said to be capable of placing a 150-pound payload, with a maximum diameter of 25 inches, into a 300-nautical-mile orbit.

Anticipated NASA and Department of Defense missions in mid-calendar year 1962 will increase this requirement to a payload of 200 pounds and a maximum diameter of 30 inches. NASA believes that by increasing the performance of the third and fourth stage motors a standard vehicle can be achieved to meet the requirements of both agencies, with a resulting simplicity of logistics and economy of production.

✓ Vehicle Changes -- Additional funds will be used to manufacture instrumentation for the vehicle that was originally conducted by NASA. During Fiscal Year 1962 a design and test effort will be initiated to determine the optimum nose cone diameter to length ratio for the standard vehicle, and to establish compatibility of electrical and destruct systems with range requirements. In addition, all of the new components will be qualified to standards established by flight test experience.

✓ Guidance and Control -- According to NASA, the initial testing of the Scout vehicle showed unexpected "roll forces" in the third stage motor which completely overpowered the roll control system. Additional funds will be applied to correction of this problem through modification, redesign, test and qualification of critical components. Funds will also be required for simplification of the basic design, and for qualification of parts.

✓ Engine Development -- Recent advances in solid propellant technology, such as those realized under the Minuteman and Polaris missile programs are the key factor in achieving a heavier Scout payload capability and larger nose cone diameter. The new motor configuration is expected to be available in the third "operational" Scout vehicle, or Scout Number 11, scheduled for mid-calendar year 1962. The Department of Defense is contributing part of the cost of this program.

✓ Ground Support Equipment -- Special test tooling and equipment will be paid for under additional funds requested by NASA in order to supply a system checkout capability at the Chance Vought plant, in order to achieve a higher level of quality control and to minimize the expensive and time-consuming procedures that would otherwise be required at the launch site.

New funds will be directed toward the development of horizontal checkout system for use at the launch site -- to cover the final checkout prior to flight. The system will be designed to minimize vehicle preparation, permit more flexible operation of the vehicle, and reduce the cost and complexity of launch operation.

* CENTAUR VEHICLE PROGRAM

National Aeronautics and Space Administration is spending some \$170 to \$180 million on its Centaur program to develop a general purpose launch vehicle of high performance and reliability for earth satellite, lunar and planetary exploration missions.

✓ Configuration -- Centaur is composed of an Atlas first stage and a new liquid hydrogen, liquid oxygen second stage. NASA considers this to be a "vitally important and urgently needed" vehicle. Its capabilities are greater than those of the Scout, Thor or Atlas-Agena B vehicles, while being capable of carrying payloads too light to warrant the use of the more expensive Saturn. Payload capabilities are 8,500 pounds in a low-earth orbit, 2,500 pounds to the Moon and 1,450 pounds to Mars or Venus.

✓ Flight Plans -- The first of 10 Centaur vehicles will be launched this year; all 10 will have been launched by early 1963.

✓ Urgent Programs -- NASA expects to receive additional funds for Centaur to speed these elements of the program:

Television System for inflight observation of propellant behavior in first three flights. Nonvisual instrumentation for this purpose has not been developed, according to NASA.

Procurement and launching of four Aerobee rockets carrying zero-gravity test articles. These tests are planned to give data on the behavior of liquid hydrogen in the airless, zero-gravity environment to be later encountered by actual Centaur flight vehicles.

Extension of ground component testing to improve confidence in the adequacy of components and launch site equipment.

Additional ground instrumentation to adapt the existing NASA world-wide instrumentation network for use with Centaur.

✓ Centaur Engine -- The second stage engine is the first flight-configured rocket engine utilizing liquid hydrogen and liquid oxygen as propellants. It features a tubular wall combustion chamber fed by a turbopump assembly that is powered on the "bootstrap" principle -- that is, the turbine derives its power solely from the heat that is transferred from the combustion chamber to the liquid-hydrogen coolant. Preliminary flight rating tests of the hydrogen engine will soon be completed. Five engines have been delivered, with eight ground test engines and sufficient flight engines for the 10 Centaur flight vehicles, plus spares, provided for in the program.

Ground testing includes tests to obtain data on storage, pumping and heat-transfer characteristics of liquid hydrogen, operation of integrated attitude control systems, jettisoning of heat-insulation panels, and tests of the operation of integrated second-stage flight propulsion systems.

✓ Future Programs -- The Centaur second stage will be used as an upper stage of the large Saturn vehicle, and all upper stages of the Saturn will utilize liquid hydrogen as a fuel. In addition, the Rover nuclear rocket engine will employ liquid hydrogen. These programs, therefore, depend in part upon success of the Centaur technology. Additional funds are being sought by NASA so that the Centaur can be used in Project Mariner, an attempt to send a complex instrumented payload to the vicinity of Venus on or about August 23, 1962. Failure to meet this date would automatically defer the Mariner launching to on or about March 30, 1964, when Venus will again be in a proper position for a "minimum energy" firing.

TECHNICAL TRENDS

□ National Aeronautics and Space Administration is stepping up its cooperation with higher education. The agency currently has more than \$8 million in grants and contracts with over 60 different universities for research and advanced development. Some details are available in Presentation No. 61-39, Public Information Office, NASA, Washington 25, D. C. ✓✓✓ Charles F. MacGowan of Kansas City, Kansas, technical adviser to the boilermakers union, will direct the Office of Saline Water Conversion in the Kennedy Administration. ✓✓✓ The office of Sen. Warren Magnuson, Chairman Commerce Committee, U. S. Senate, Washington 25, D. C. has available the text and explanation of proposed new legislation for a ten year program of oceanographic and Great Lakes research and surveys. ✓✓✓ U. S. Army Transportation Research Command, Ft. Eustis, Va. is looking for firms with capabilities in automotive engineering design and construction for modification of a truck-tractor as a shuttle tractor test bed. Write to the Command in care of the Contracting Officer.

□ Information on the sale of surplus quantities of arsenical nickel ore and nickel-cobalt (Burma) speiss is available from Industry Branch, Project Administration, DMS, Room 6030, GSA Bldg., Washington 25, D. C. ✓✓✓ The U. S. Bureau of Mines has placed on file in its libraries at Washington and Albany, Ore. a new report indicating that synthetic bornite and bornite-type materials of the highest purity now obtainable possess no advantages over the natural crystalline compound of copper, iron and sulfur for thermoelectric and semiconductor applications. ✓✓✓ Studies by the National Academy of Sciences, Washington 25, D. C. indicate that large high schools are three times more effective in producing Ph.D's than high schools of average size -- and six times more effective than the smallest.

□ Development of a gas turbine for marine and vehicular applications will be attempted by the Ford Motor Company and Solar Aircraft Co. under a \$9.5 million contract, with cost shared by the Army and Navy. Fuel consumption comparable to diesels, and superior to gasoline engines is a main goal. ✓✓✓ Information Office, U. S. Department of Labor, Washington 25, D. C. has available Industry Manpower Survey No. 98 showing that employment in the computing machines industry increased from 64,700 in 1956 to 103,000 by September, 1960.

□ Agenda is now available for a one-day symposium on Uranium Carbides as Fuel Reactor Materials to be held at Atomic Energy Commission's Germantown, Md. Headquarters, April 4, 1961. Advance registration is not required but Industrial Cooperation Branch, Division of Reactor Development, U. S. AEC, Washington 25, D. C. will arrange transportation. ✓✓✓ Information Office, Department of Commerce, Washington 25, D. C. has available Announcement G 61-30 outlining "the largest research program ever attempted to study tornadoes, squall lines and severe local storms." ✓✓✓ Proposals for research and development directed toward a shipboard oil and water separator to prevent sea pollution must be submitted by March 20, 1960 to the Research and Development Office, Maritime Administration, Washington 25, D. C. ✓✓✓ RCA is developing for the Navy the "Rena" satellite, a 100 pound device for tactical "pushbutton" readout of cloud cover and other weather information based on miniaturized Tiros satellite principles. An instrumented van would permit similar use by the Army in the field. ✓✓✓ The Marine Corps is interested in firms capable of developing small (250 sq. ft.) and medium (800 sq. ft.) portable field shelters. Write the Commandant, USMC, Washington 25, D. C.

RESEARCH CHECKLIST

- THE CEILOMETER COMPUTER: The National Bureau of Standards has developed a ceilometer computer for display and readout of cloud-height information in an automatic weather station. The computer, a wired-program machine, is constructed of transistorized plug-in packages. It receives an analog signal from the detector of a rotating-beam ceilometer -- a device which measures the height of clouds from the ground up to about 10,000 feet. A small magnetic storage drum in the computer contains about ten minutes of cloud-height information which is continuously updated, and can be analyzed for a number of factors.

(Technical details available in National Bureau of Standards Technical Note No. 64, available at \$2 from OTS, U. S. Department of Commerce, Washington 25, D. C.)

- MASONRY PRIMER-SEALER: A new primer-sealer has been developed by the Navy for use on weathered masonry surfaces. The material was discovered in the course of research to improve latex linings for fuel storage tanks, but the new application may be of much greater value. The primer-sealer contains a commercially available material of the isocyanate type, and is said to show promise as a base coating on various masonry surfaces prior to the application of acrylic emulsion paints.

(R&D by J. R. Griffith and G. E. Rohl, Chemistry Division, Organic and Biological Chemistry Branch, U. S. Naval Research Laboratory, Washington 25, D. C. Details to be published in the near future as NRL Report No. 5580)

- NEW TECHNIQUE FOR HYPERVELOCITY IMPACT TESTING: National Aeronautics and Space Administration has proved the feasibility of using two facing guns in testing the effect of hypervelocity impact on construction materials. Relative velocity of facing guns is believed to be much greater than that possible with light gas guns. Preliminary tests of this technique reached impact velocities of only 21,850 fps but the ordnance equipment used was of an obsolete type and ultimate capability should exceed 40,000 fps -- well over the speed of sound in construction materials scheduled for use in space vehicles. Current high velocity test equipment cannot reach sonic speed in such materials, which causes doubt about the validity of present ground tests on meteoritic impact damage.

(Complete test information is contained in NASA TN D-724 available from National Aeronautics and Space Administration, ATTN: Code BID, 1520 H Street, N. W., Washington 25, D. C.)

- FOAM PLASTIC STRUCTURES: Army Engineers are testing a "buildings in barrels" concept which envisions the shipment of liquid plastic to military construction sites, where the chemicals would be mixed to form a rigid building material of plastic foam. Approximately 30 cubic feet of building material can be obtained from each cubic foot shipped. Costs approximate \$1.50 per cubic foot of 1.8 pound per cubic foot density foam, or about \$1 per pound in liquid form. An experimental building has been constructed of panels foamed in place in molds somewhat similar to a metal casing. Although it can be reinforced in many ways, the most promising, according to the Army, is to spray with polyester or epoxy fiberglass resin, perhaps both inside and outside as needed. Studies indicate the building to be lightweight, strong and flexible, with additional advantages such as low thermal conductivity and low moisture absorption.

(R&D reported by Technical Liaison Office, U. S. Army Engineer Research and Development Laboratories, Ft. Belvoir, Va.)

P U B L I C A T I O N C H E C K L I S T

- ATOMIC ENERGY LEGISLATION, a collection of statutes and pertinent material relating to the general area of atomic energy legislation through the 86th Congress, Second Session. 253 Pages. Single Copies Free. (Write Joint Committee on Atomic Energy, F-88, The Capitol, Washington, D. C.)
- NATIONAL SCIENCE ACADEMY, a transcript of hearings on proposals for establishment of a National Academy for scientific training. 54 Pages. Single Copies Free. (Write Committee on Science and Astronautics, New House Office Building, Washington 25, D. C. for Hearings -- National Science Academy)
- AIRCREW EQUIPMENT, a September, 1960 catalog to illustrate and describe both personal equipment for aircrews and equipment installed in aircraft that is of particular interest to aircrews. Includes survival equipment, oxygen equipment, etc. 140 Pages. (Available as WADD-Tn-60-230 through military channels or at \$3 ((PB 171 119)) from OTS, U. S. Department of Commerce, Washington 25, D. C.)
- FACILITIES AND EQUIPMENT FOR SCIENCE AND MATHEMATICS EDUCATION, a Government handbook dealing primarily with official requirements and recommendations of State departments of education in regard to facilities, equipment and instructional material for science and mathematics in elementary and secondary schools. 130 Pages. \$1. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for Pub. FS 5.221:21000)
- METALS FOR SPACE ENVIRONMENT, a fine review of environmental factors in space, in planetary atmospheres and in energy conversion systems being developed for space vehicles. Worthwhile reading for anyone in these fields. 46 Pages. Free to Government agencies, contractors, subcontractors and their suppliers. (Write Defense Metals Information Center, Columbus 1, Ohio regarding DMIC Report No. 142)
- CONTROLLING RADIATION EMERGENCIES, a compendium of training material and general information on the control of emergency situations. Includes a reference list for further reading. 98 Pages. (Available as TID-8206 (Rev.) through AEC channels or at \$1 from OTS, U. S. Department of Commerce, Washington 25, D. C.)
- AEC RESEARCH REPORTS, a new edition of the semi-annual price list of all unclassified reports of Atomic Energy Commission research. 61 Pages. Single Copies Free. (Write OTS, U. S. Department of Commerce, Washington 25, D. C. for AEC Research Reports Price List No. 35)
- IAF MEETING, a report to Congress on the eleventh annual meeting of the International Astronautical Federation. 34 Pages. Single Copies Free. Write Committee on Science and Astronautics, New House Office Building, Washington 25, D. C. for "Report on the Eleventh Annual Meeting of the IAF")
- AIR FORCE ICBM CONSTRUCTION, testimony, transcripts and exhibits on the missile base construction program, some of which makes the WPA look like a model of efficiency. 310 Pages. (Write Subcommittee on Military Construction, Committee on Appropriations, U. S. House of Representatives, The Capitol, Washington D. C. for Missile Base Construction Hearings)
- PATENTS AND TECHNICAL INFORMATION AGREEMENTS, a study of the bilateral patent and technical information agreements which the U. S. has entered into with 12 foreign countries. 78 Pages. (Write Subcommittee on Patents, Committee of the Judiciary, U. S. Senate, Washington, D. C. regarding Patent Study No. 24)

